Highly Sensitive *In Vitro* Diagnostics Using SERS-Based Microdevices

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A novel surface-enhanced Raman scattering (SERS)-based bioassay platforms have been developed for highly sensitive *in vitro* diagnostics [1,2]. SERS-based lateral flow immunoassay (LFA) biosensor was developed to resolve problems associated with conventional LFA strips (e.g., limits in quantitative analysis and low sensitivity). With the proposed SERS-based LFA strip, the presence of a target antigen can be identified through a colour change in the test zone. Furthermore, highly sensitive quantitative evaluation is possible by measuring SERS signals from the test zone [3,4]. To verify the feasibility of the SERS-based LFA strip platform, an immunoassay of staphylococcal enterotoxin B (SEB) and a DNA assay of HIV-1 virus were performed as model reactions. The limit of detection (LOD) values are much more sensitive than those achieved with the corresponding ELISA or PCR methods.

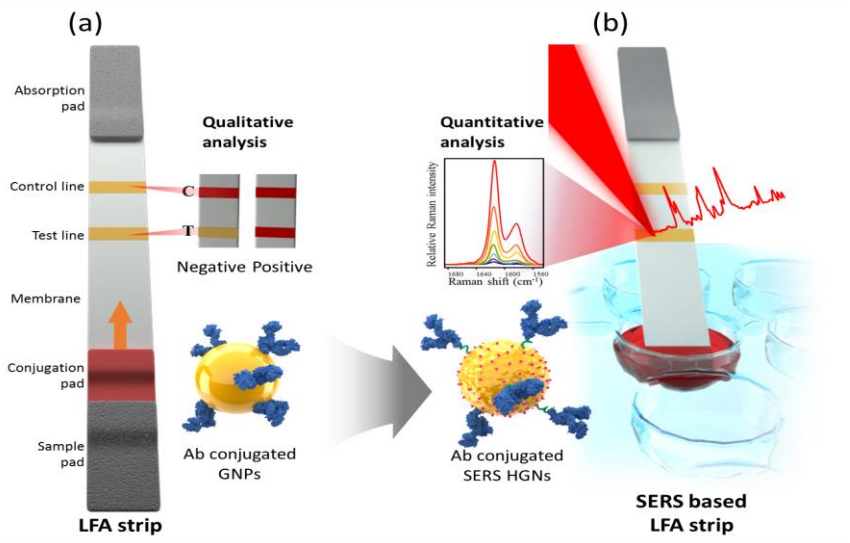

Figure 1. Schematic illustration of SERS-based lateral flow assay platform

The development of SERS-based microfluidic platforms has also attracted significant recent attention in the biological sciences. SERS is a highly sensitive detection modality, with microfluidic platforms providing many advantages over microscale methods, including high analytical throughput, facile automation and reduced sample requirements. Accordingly, the integration of SERS with microfluidic platforms offers significant utility in chemical and biological experimentation [5,6]. Herein, we report a fully integrated SERS-based microdroplet platform for the automatic immunoassay of specific biomarkers. These novel SERS-based assay platforms are expected to be powerful clinical tools for early disease diagnosis.

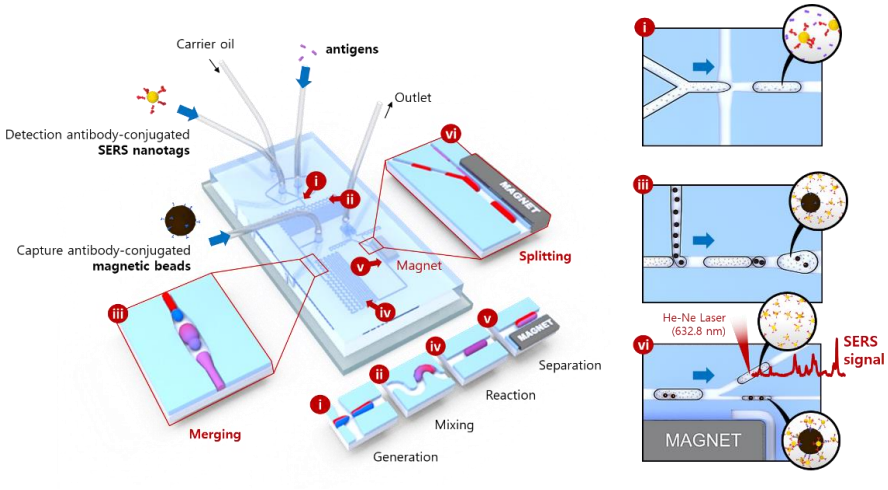

Figure 1. Schematic illustration of SERS-based microfluidic assay platform composed of six droplet compartments

ACKNOWLEDGMENTS

This work was supported by the National Research Foundation of Korea (Grant No. 2009-00426).

REFERENCES

[1] Cheng, Z., Choi, N., Wang, R., Lee, S., Moon, K. C., Yoon, S. Y., Chen, L., Choo, J., *ACS Nano* 2017; **11**: 4926-4933.
[2] Gao, M., Ly, C., Choo, J., Chen, L., *Chem. Soc. Rev.* 2017; **46**: 2237-2271.
[3] Hwang, J., Lee, S., Choo, J., *Nanoscale* 2016; **8**: 11418-11425.
[4] Wang, X., Choi, N., Cheng, Z., Ko, J., Chen, L., Choo, J., *Anal. Chem.*, 2017; **89**: 1163-1169.
[5] Gao, R., Cheng, Z., deMello, A., Choo, J., *Lab Chip* 2016; **16**: 1022-1029.
[6] Choi, N., Lee, J., Ko, J., Jeon, J. H., Rhie, G., deMello, A., Choo, J., *Anal. Chem.*, 2017; **89**: 8413-8420.